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ABSTRACT

Returns to Education in Australia 2001-2022*

What are the economic returns to education in Australia? Using data from the 2018-2022 waves of the Household, Income and Labour Dynamics in Australia survey, and taking account of existing estimates of ability bias and social returns to schooling, I estimate the economic return to various levels of education. As in Leigh (2008), which used data from the 2001-2005 waves of the same survey, I report large returns. Across high school, vocational education and university qualifications, an additional year of schooling raises hourly wages by 7 percent, boosts annual earnings by 13 percent, and increases the probability of reporting positive earnings by 4 percentage points. In terms of hourly wages, the largest per-year returns are from completing a Bachelor degree. In terms of annual earnings, the largest per-year returns are from completing year 12. Testing for changes in returns to schooling over time provides little evidence of systematic trends over the period 2001-2022. Over the lifecycle, returns to education tend to decline from age 60 for high school and vocational qualifications, and tend to decline from age 55 for university qualifications, suggesting that the value of education diminishes as workers approach retirement age.

JEL Classification: I28, J31

Keywords: returns to education, ability bias, high school, vocational training, university

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1 Introduction

Education is one of the highest-yielding investments individuals and societies can make. People with higher levels of formal education are more likely to be employed. Conditional on being employed, those with more education tend to earn higher wages. Education has non-wage benefits too. People with more years of education tend to be healthier (Grossman and Kaestner 1997), live longer (Clarke and Leigh 2011), and are less likely to be incarcerated (Lochner and Moretti 2004). At a societal level, education is associated with productivity spillovers to co-workers and children (Oreopoulos, Page and Stevens 2006; Gunderson and Oreopolous 2020).

Estimating the precise returns to education is therefore an issue of considerable policy importance. For individuals, the returns to education may help decide which forms of education to pursue, and how to prioritise educational investment vis-à-vis other investments (such as housing or share market investments). For societies, the returns to education are relevant in determining the extent of public subsidy that should be provided to different kinds of educational investment.

A substantial literature explores returns to education in Australia. This includes studies focused on adjusting for ability bias (Miller, Mulvey and Martin 2006; Leigh and Ryan 2008; Wilkins 2015, 70-73), testing for changes in the rate of return to education over time (Corliss et al 2013; Wei 2016; Corliss et al 2020), estimating the returns to different kinds of qualifications (Leigh 2008; Long and Shah 2008; Sinning 2014), estimating returns to different university fields of study (Borland 2002; Norton 2012; Daly et al 2015), and estimating the phenomena of over-education and under-education (Kler 2005; Dockery and Miller 2012). Some studies have sought to estimate the per-year returns to education. However, this may be biased upwards due to the fact that many people fail to complete courses or have multiple qualifications (for example, Peters, Dockery and Bawa 2022 note that among those Australians with a Masters degree, 12 percent have more than one Masters degree).

Leigh (2008) estimated the returns to education using data from the 2001-2005 waves of the Household, Income and Labour Dynamics in Australia survey (HILDA), the first five years of the survey. Using the same methodology, this paper updates those estimates using data from the 2018-2022 waves of the HILDA survey – the most recently available five years. I then use data for all available waves of the survey (2001-2022) to conduct two new exercises. The first is to estimate returns to education for each individual survey year, to see whether returns to education have risen or fallen over this two-decade period. The second is to estimate returns to education for each individual year of age, to see whether returns to education rise or fall across the lifecycle. Naturally, these two exercises are conducted independently, so the estimation of returns over time controls for age effects, while the estimation of returns across the lifecycle controls for year effects.

To preview the results, I find that returns to education in the period 2018-2022 are similar to those in the period 2001-2005. Across the entire period 2001-2022, I find little evidence that the returns to schooling have changed. However, testing for changes in returns to schooling over the lifecycle suggests that returns tend to decline from age 60 for high school and vocational qualifications, and tend to decline from age 55 for university qualifications.

The remainder of the paper is structured as follows. Section 2 outlines the methodology. Section 3 presents returns to education for the period 2018-2022. Section 4 shows how returns to education have changed over time and across the lifecycle. The final section concludes.

2 Methodology for Estimating Returns to Education

If educational qualifications were randomly distributed across the population, then the observed association between education and earnings could be interpreted as causal. However, because people choose how much education to acquire, there is the potential for 'ability bias', in which the relationship between education and earnings is biased by an association between innate ability and levels of education. In principle, this might go either way. For example, if high-ability people are keen to enter the labour market, they may eschew formal qualifications in favour of work. Conversely, if high-ability people enjoy education more, they may choose to obtain higher qualifications.

To estimate the degree of ability bias, researchers have used a variety of natural experiment techniques. In the Australian context, these have included twin pair comparisons (Miller, Mulvey and Martin 2006), comparisons of people born on either side of the school starting date (Leigh and Ryan 2008), and comparisons that use changes in compulsory school leaving ages (Leigh and Ryan 2008). Twin pair comparisons operate on the assumption that people with similar genes have a similar level of innate ability, so that if one twin obtains more schooling, then any earnings difference must be due to the causal impact of education on earnings. Birth timing estimates work on the basis that a child born just before the school starting age cutoff will start school almost one year younger than a child born just after the school starting age cutoff. If both children leave at the compulsory leaving age, then the former child will obtain almost a year more formal schooling than the latter child. To the extent that birth dates are uncorrelated with ability, this provides a measure of ability bias. Compulsory school leaving age compares children in a jurisdiction before the leaving age is raised with the cohort of children in the same jurisdiction after the leaving age is raised.

These are not the only ways of identifying causal effects. For estimates of the returns to graduate school, it is also possible to use individual fixed effects estimators, but this approach is only suitable for instances in which it is possible to observe a reliable estimate of earnings in the pre-education and post-education periods, which is not the case for most kinds of educational qualifications. In the United States, researchers have used instrumental variables based on distance to the nearest university or to the tuition charged by nearby universities, but neither approach is well suited to the Australian context. Another approach is to use regression discontinuity: comparing students on either side of a cutoff for admission into university. Although this approach could in principle be deployed in Australia, researchers are yet to do so, perhaps due to limitations in the available administrative data.

As noted in Leigh (2008), estimates for Australia have tended to find evidence of an upwards ability bias, suggesting that those who would have performed better in the labour market tend to obtain higher levels of formal education. Using twin pairs, Miller, Mulvey and Martin (2006) estimate returns to education that suggest upwards ability bias in the order of 10-28 percent. Using variation in birth timing, Leigh and Ryan (2008) estimate an upwards ability bias of 39 percent. Exploiting variation in compulsory schooling laws across Australian states, Leigh and Ryan (2008) estimate an upwards ability bias of 9 percent. In the United States, studies differ over the extent of ability bias. Card (1999) sums up the US literature by concluding that most studies find a *downwards* ability bias, while Heckman, Humphries and Veramendi (2018) identify significant upwards ability bias (which they prefer to call selection bias) in the observed association between education and earnings.

In what follows, I present results that assume the ordinary least squares returns are biased upwards by 10 percent. For readers who take the view that the ability bias is outside this range, it is relatively straightforward to adjust the estimates accordingly. Note that this approach assumes that the extent of ability bias estimated in natural experiment studies (most of which is based on differences in high school attainment) can be applied to all educational qualifications. To the extent that ability bias differs substantially between high schooling, vocational training, and university, this method may imprecisely estimate the causal impact of these different types of education.

Another question is the degree to which one should adjust returns to take account of social benefits. For ease of comparability with Leigh (2008), I account for social returns to education by estimating results using pre-tax earnings. This takes account of the increase in taxation revenue that flows from higher educational attainment, but ignores indirect benefits such as productivity spillovers to co-workers, intergenerational benefits to children, and higher levels of civic participation. To the extent that education lowers the chance that an individual will fall sick or be incarcerated, this approach takes account of the fall in earnings, but not the additional governmental expenditure on public health care and prison spending.

The empirical strategy in this paper is based on a standard ordinary least squares regression of earnings on educational and demographic characteristics. Following Mincer (1974), this takes the form:

$$\ln Y_{it} = \beta_0 + \beta_1 \mathbf{E_{it}} + \beta_2 \mathbf{X_{it}} + \gamma_t + \varepsilon_{it} \quad (1)$$

In this equation, Y is a measure of the earnings of individual i in year t, and E is a vector of educational levels. X is a vector of individual characteristics, comprising indicator variables for single years of actual work experience, interacted with sex dummies. This allows for a fully flexible experience-earnings profile, which differs between men and women. Finally, γ is a survey year fixed effect, and ε is a disturbance term.

Earnings data for the updated estimates are from the 2018-2022 waves of the HILDA survey, which was drawn randomly from the Australian population. In principle, one might be concerned that because this five-year window spans the COVID pandemic, it is not representative of returns to education in the years immediately before or after the pandemic. However, in practice this does not appear to be a major problem. For most workers, COVID did not lead to substantial wage increases or decreases. Income support payments were increased, and the JobKeeper wage subsidy was provided to employers, but income supports and JobKeeper are not included in earnings, which are the main focus of this article. Below, I present estimates of returns to education in each individual year from 2001 to 2022 (Figures 1, 2 and 3). The main COVID lockdown years (2020 and 2021) do not particularly stand out on these graphs.

To account for the fact that the same individuals' labour market outcomes may be correlated over time, standard errors are clustered at the person level. Respondents are restricted to those aged between 25 and 64 in the year of the survey. This age restriction is designed to cover the working population, and to ensure that most respondents have had adequate time to complete their education. Respondents who are studying full-time or part-time are also dropped.

In estimating returns to education, a common approach is to convert all forms of education into years of education, and then to estimate the effect of an additional year of schooling on earnings or labour market participation. While such an approach has the virtue of simplicity, it effectively constrains the returns to an additional year of education to be the same for all types of schooling. Here, the focus is on different types of schooling, so I separately analyse schooling, vocational education, and university. In doing so, it is important to recognise that individuals follow different educational pathways. For example, among those who have finished grade 12, 52 percent have a university degree as their highest qualification, while only 16 percent have a Certificate Level III/IV as their highest qualification. By contrast, among those who have not finished grade 12, 44 percent have a Certificate Level III/IV as their highest qualification. It is therefore plausible that post-school education is tailored according to the level of high schooling that the typical student has attained, and that the returns to post-school education may differ systematically by high school attainment.

Table 1 shows the breakdown of educational qualifications in the sample. Compared with Leigh (2008), there has been an increase in average educational attainment levels from the 2001-2005 sample to the 2018-2022 sample. In the more recent period, a greater share of the population had finished high school or completed a post-school qualification.

Table 1
Distribution of Educational Qualifications

	Positive hourly wages	Positive annual earnings	Full sample
High school sample (used in Table 2)			
Respondents with no post-school qualifications			
Grade 9	5%	6%	8%
Grade 10	24%	25%	27%
Grade 11	14%	14%	15%
Grade 12	57%	56%	51%
N	*8,896*	*9,789*	*14,105*
Vocational training sample (used in Table 3)			
Respondents with 11 or fewer years of schooling			
No post-school qualifications	41%	41%	45%
Certificate Level III or IV	48%	48%	45%
Diploma or Advanced Diploma	11%	11%	10%
N	*11,174*	*12,457*	*18,353*
Post-school qualifications sample (used in Table 4)			
Respondents with 12 years of schooling			
No post-school qualifications	19%	19%	20%
Certificate Level III or IV	16%	16%	16%
Diploma or Advanced Diploma	11%	11%	12%
Bachelor degree	31%	31%	29%
Graduate Diploma or Graduate Certificate	10%	10%	10%
Masters or Doctorate	14%	14%	13%
N	*25,534*	*27,487*	*32,798*

Note: Percentages may not add to 100 due to rounding. All respondents are aged between 25 and 64, and not presently studying, in the 2018-2022 waves of the HILDA survey. A small number of respondents have university qualifications, but did not complete high school. These respondents are not included in the analysis. Sample size is observations, not individuals.

To test for productivity and participation effects, I estimate three sets of regressions. The first set of regressions uses as the dependent variable pre-tax log hourly wages (calculated as weekly gross wages and salary for all jobs divided by usual weekly hours for all jobs). The second uses log pre-tax annual earnings. Inherent in such a specification is the notion that education increases income in a proportional manner (eg. by *y* percent), rather than by a fixed sum (eg. by *y* dollars). All effects are converted into percentage impacts, using the standard formula that the percentage effect is equal to $\exp(\beta)-1$. This percentage impact is then scaled down by 10 percent to account for ability bias. Thus the percentage impacts that are shown at the bottom of the results tables are derived as $0.9\times(\exp(\beta)-1)$.

The main disadvantage of using logs is that the relationship between education and income can only be estimated for those with positive income. For this reason, I estimate a third regression, in which the dependent variable is an indicator denoting whether the respondent had positive earned income in the previous financial year. This regression is estimated using a probit model, and takes the following form:

$$\Pr(Y>0)_{it} = \beta_0 + \beta_1\mathbf{E}_{it} + \beta_2\mathbf{X}_{it} + \gamma_t + \varepsilon_{it} \qquad (2)$$

The relationship between education and hourly wages (shown in the first column of Tables 2, 3 and 4) may be regarded as capturing the productivity effect – how the amount that a person earns for a fixed period of work varies with education. The relationship between education and annual earnings (shown in the second column) may be regarded as capturing both productivity and participation – how wages and hours worked vary with education. The relationship between education and having positive annual earnings (shown in the third column) may be regarded as capturing participation only.

3 Returns to Education in 2018-2022

To begin, I focus on the relationship between high school completion and earnings. To ensure that effects are not contaminated by those who have undertaken post-school education, the sample is restricted to respondents with between 9 and 12 years of schooling, and no post-school qualifications.

Table 2 shows the results of these regressions. Panel A presents the basic regression results, while Panel B converts the regression coefficients into percentage effects (assuming a 10 percent upwards ability bias). For simplicity, in what follows, I focus the exposition on percentage effects (the results shown in Panel B of each table).

The hourly wage results in column (1) of Table 2 suggest substantial productivity effects for years 11 and 12 (the effects of year 10 schooling are positive, but not statistically significant). Compared with those who completed grade 9, workers who completed grade 11 have hourly wages that are 14 percent higher, and workers who finish grade 12 have hourly wages that are 23 percent higher. The effects of completing year 12 are even larger when participation effects are taken into account. In column (2), annual earnings are a massive 44 percent higher among those who have finished year 12.

In all cases, more schooling is also associated with a greater probability of reporting positive earnings (column 3). Compared with people who only completed year 9, finishing year 11 is associated with a 9 percentage point increase in the odds of reporting positive earnings. Finishing year 12 is associated with a 22 percentage point increase in the odds of reporting positive earnings. These results suggest that the impact of high school on annual earnings occurs through both productivity and participation.

Table 2

High School and Earnings

Sample is respondents with 9-12 years of schooling and no post-school qualifications. All estimates are relative to those who left school at the end of grade 9.			
Panel A: Regression results			
	(1)	(2)	(3)
Dependent variable:	**Log hourly wage**	**Log annual earnings**	**Indicator for positive earnings**
Grade 10	0.100	0.109	0.051
	(0.061)	(0.094)	(0.034)
Grade 11	0.142**	0.178*	0.094***
	(0.064)	(0.099)	(0.034)
Grade 12	0.226***	0.401***	0.215***
	(0.062)	(0.094)	(0.034)
Individuals	2,370	2,526	3,309
Observations	8,896	9,789	*14,105*
R^2 or Pseudo-R^2	0.08	0.19	0.17
Panel B: Percentage effects - assuming 10% upwards ability bias			
Grade 10	9% (ns)	10% (ns)	5% (ns)
Grade 11	14%	18%	9%
Grade 12	23%	44%	22%

Note: Robust standard errors, clustered at the person level, in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively. All specifications are estimated for respondents aged between 25 and 64, and not presently studying, observed in the 2018-2022 waves of the HILDA survey. Specifications in column 1 are restricted to those with positive hourly wages, and specifications in column 2 are restricted to those with positive annual earnings. Regressions in columns 1 and 2 are estimated using ordinary least squares, and estimates in column 3 are marginal effects from a probit model. All regressions include indicator variables for each single year of experience, interacted with the respondent's sex, plus year fixed effects. For columns 1 and 2, results in Panel B are calculated as $0.9\times(\exp(\beta)-1)$. For column 3, results in Panel B are identical to the marginal effects shown in Panel A. In Panel B, 'ns' denotes results that are not statistically significant at conventional levels.

Recalling the earlier discussion about educational pathways, I next turn to consider vocational qualifications. In its earlier waves, the HILDA dataset separately coded people with Certificate Level I or II, and vocational certificates with an undefined level. Thus Leigh (2008) included analysis of returns to Certificate I/II qualifications (and found results that were generally small and statistically insignificant). However, starting with wave 12 of HILDA (the 2012 survey), Certificate I/II qualifications and vocational certificates with an undefined level have been recoded as 'year 11 and below' to make the education variable correctly ordinal.

The present analysis of vocational qualifications therefore focuses on just two sets of qualifications. The first are Certificate Level III or IV, which enable graduates to provide technical advice of a complex nature in a specific field. The second are Diploma qualifications, which incorporate an even greater focus on fundamental principles and conceptual skills; and Advanced Diplomas, which are designed to provide greater depth across an unpredictable variety of contexts.

Table 3 restricts the sample to respondents with 11 or fewer years of schooling (but controls for single years of schooling). As in the previous table, the dependent variable is hourly wages in the first column, annual earnings in the second column, and an indicator for positive annual earnings in the third column. Again, Panel B converts the coefficients into percentage effects, assuming a 10 percent upwards ability bias.

Table 3
Vocational Training and Earnings

Sample is respondents with 11 or fewer years of schooling. All estimates are relative to those with 11 or fewer years of schooling and no post-school qualifications.			
Panel A: Regression results			
	(1)	(2)	(3)
Dependent variable:	**Log hourly wage**	**Log annual earnings**	**Indicator for positive earnings**
Certificate Level III or IV	0.084***	0.162***	0.038**
	(0.019)	(0.032)	(0.018)
Diploma or Advanced Diploma	0.175***	0.352***	0.092***
	(0.030)	(0.046)	(0.027)
Individuals	2,991	3,217	4,272
Observations	11,174	12,457	18,353
R^2 or Pseudo-R^2	0.09	0.20	0.14
Panel B: Percentage effects - assuming 10% upwards ability bias			
Certificate Level III or IV	8%	16%	4%
Diploma or Advanced Diploma	17%	38%	9%

Note: Robust standard errors, clustered at the person level, in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively. All specifications are estimated for respondents aged between 25 and 64, and not presently studying, observed in the 2018-2022 waves of the HILDA survey. The category '11 or fewer years of schooling' includes only school-based schooling (not vocational education). Specifications in column 1 are restricted to those with positive hourly wages, and specifications in column 2 are restricted to those with positive annual earnings. Regressions in columns 1 and 2 are estimated using ordinary least squares, and estimates in column 3 are marginal effects from a probit model. All regressions include indicator variables for each single year of experience, interacted with the respondent's sex, plus year fixed effects. For columns 1 and 2, results in Panel B are calculated as $0.9\times(\exp(\beta)-1)$. For column 3, results in Panel B are identical to the marginal effects shown in Panel A.

Column (1) of Table 3 suggests that – for individuals who have not finished high school – the increase in hourly wages (the productivity benefit) is 8 percent for Certificate III/IV, and 17 percent for Diplomas. Column (2) of Table 3 shows that the increase in annual earnings associated with Certificate III/IV qualifications and Diplomas is twice as large as the hourly wage benefit: 16 percent for Certificates and 38 percent for Diplomas. Column (3) of Table 3 shows that both forms of vocational education are associated with higher participation rates: 4 percentage points higher for Certificates and 9 percentage points higher for Diplomas. This suggests that higher-level vocational training has an economic payoff, but that it is as much through participation effects as productivity effects.

In Table 4, I estimate the returns to post-school qualifications, relative to respondents with 12 years of schooling and no post-school qualifications. In addition to Certificate III/IV qualifications and Diplomas, I now estimate the returns to three types of university qualifications: Bachelor degrees, Graduate Diplomas/Certificates, and Masters/Doctorate degrees.

For those who have completed grade 12, Certificate III/IV qualifications have no statistically significant effect on productivity or participation. Diplomas are associated with 7 percent higher hourly wages and 11 percent higher annual earnings (for a similar finding using different data, see Lee and Coelli 2010).

The economic returns to Bachelor degrees are around three times as large as the returns to Diplomas. Bachelor degrees are associated with a 29 percent increase in hourly wages, and a 41 percent increase in annual earnings.

Workers with Graduate Diplomas and Graduate Certificates earn hourly wages that are 37 percent higher, and annual earnings that are 40 percent higher. Those with Masters degrees and Doctorates earn hourly wages that are 47 percent higher, and annual earnings that are 68 percent higher. All three forms of university qualifications are associated with a 7 to 10 percentage point increase in labour force participation.

Note that several other studies have explored specific aspects of returns to education in Australia. For example, Perales and Chesters (2017) use panel data to estimate within-person returns to mature-aged educational upgrading, while Daly et al (2015) use Census data to estimate differential returns according to field of study.

Table 4
Post-School Qualifications and Earnings

Sample is respondents with 12 years of schooling. All estimates are relative to those with no post-school qualifications.

Panel A: Regression results			
	(1)	(2)	(3)
Dependent variable:	**Log hourly wage**	**Log annual earnings**	**Indicator for positive earnings**
Certificate Level III or IV	0.015	0.048	0.020
	(0.019)	(0.035)	(0.014)
Diploma or Advanced Diploma	0.079***	0.119***	0.010
	(0.025)	(0.038)	(0.016)
Bachelor degree	0.283***	0.372***	0.081***
	(0.021)	(0.033)	(0.012)
Graduate Diploma or Graduate Certificate	0.346***	0.367***	0.070***
	(0.024)	(0.045)	(0.014)
Masters or Doctorate	0.422***	0.563***	0.102***
	(0.024)	(0.039)	(0.011)
Individuals	6,389	6,653	7,434
Observations	25,534	27,487	32,798
R^2 or Pseudo-R^2	0.20	0.21	0.09
Panel B: Percentage effects - assuming 10% upwards ability bias			
Certificate Level III or IV	1% (ns)	4% (ns)	2% (ns)
Diploma or Advanced Diploma	7%	11%	1% (ns)
Bachelor degree	29%	41%	8%
Graduate Diploma or Graduate Certificate	37%	40%	7%
Masters or Doctorate	47%	68%	10%

Note: Robust standard errors, clustered at the person level, in brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively. All specifications are estimated for respondents aged between 25 and 64, and not presently studying. Specifications in column 1 are restricted to those with positive hourly wages, and specifications in column 2 are restricted to those with positive annual earnings. Regressions in columns 1 and 2 are estimated using ordinary least squares, and estimates in column 3 are marginal effects from a probit model. All regressions include indicator variables for each single year of experience, interacted with the respondent's sex, plus year fixed effects. For columns 1 and 2, results in Panel B are calculated as $0.9\times(\exp(\beta)-1)$. For column 3, results in Panel B are identical to the marginal effects shown in Panel A. In Panel B, 'ns' denotes results that are not statistically significant at conventional levels.

Next, I compare the returns to various educational qualifications on a per-year basis. Since there is no firm duration for most qualifications, it is necessary to make some assumptions about the number of full-time equivalent years that would be required. In Table 5, I assume that each year of high schooling takes 1 year (ie. ignoring the possibility of students repeating a grade). The marginal benefit of grade

11 is estimated as the return to completing grade 11 minus the return to completing grade 10 (and similarly for the marginal return to completing grade 12). Post-school qualifications are assigned the following durations: 1 year for Certificate III/IV, 2 years for a Diploma or Advanced Diploma, 3 years for a Bachelor degree, 4 years for a Graduate Diploma or Graduate Certificate, and 5 years for a Masters or Doctorate (note that the last two estimates include the time taken to complete a Bachelor degree). I then divide the returns in Tables 2, 3 and 4 by the respective number of years.

As Panel A of Table 5 indicates, the benefits of completing the final three years of high school are not linear. Completing year 12 has a larger impact on employment and earnings than completing year 10 (where the effects are statistically insignificant) or year 11 (where the effects are one-half to one-third the size of the year 12 effects).

Table 5 permits a comparison of the per-year returns to education across all forms of education (high school, vocational and university). Looking down column (1), the per-year productivity gains are surprisingly similar across a range of qualifications. Grade 12, Diplomas and Advanced Diplomas, Graduate Diplomas and Graduate Certificates, and Masters and Doctorates are all associated with an statistically significant hourly wage boost of 9 percent per year. Just below these, Certificate III/IV are associated with an 8 percent hourly wage increase. The highest per-year boost in hourly wages comes from Bachelor degrees, at 10 percent per year.

For annual earnings (column 2), per-year benefits are largest from grade 12, with completion boosting annual earnings by a whopping 27 percent. For people who have not completed high school, vocational qualifications boost annual earnings by 16 to 19 percent per year of study (but have a much smaller impact for those who have completed high school). In annual earnings terms, Bachelor, Masters and Doctorate degrees are associated with a 14 percent annual earnings increase per year of study, while Graduate Diplomas and Graduate Certificates are associated with a 10 percent increase per year of study.

For positive earnings (column 3), per-year benefits are largest from completing high school, at 12 percent. Vocational training boosts the odds that someone who has not finished high school will participate in the labour market, but has no statistically significant effect on the participation odds among high school graduates. Among high school graduates, university qualifications are associated with only a small per-year increase in the odds of reporting positive earnings.

In the final row of Table 5, I take an average of all per-year education effects. On average, a year of education boosts hourly wages by 7 percent, raises annual earnings by 13 percent, and increases the probability of reporting positive earnings by 4 percentage points.

Table 5
Per-Year Returns to Education

All results are percentage effects, assuming 10% upwards ability bias			
	(1)	(2)	(3)
Dependent variable:	**Log hourly wage**	**Log annual earnings**	**Indicator for positive earnings**
Panel A: High school and earnings			
Sample is respondents with no post-school qualifications			
Grade 10	9% (ns)	10% (ns)	5% (ns)
Grade 11	4%	7%	4%
Grade 12	9%	27%	12%
Panel B: Vocational training and earnings			
Sample is respondents with 11 or fewer years of high school			
Certificate Level III or IV	8%	16%	4%
Diploma or Advanced Diploma	9%	19%	5%
Panel C: Post-school qualifications and earnings			
Sample is respondents with 12 years of high school			
Certificate Level III or IV	1% (ns)	4% (ns)	2% (ns)
Diploma or Advanced Diploma	4%	6%	1% (ns)
Bachelor degree	10%	14%	3%
Graduate Diploma or Graduate Certificate	9%	10%	2%
Masters or Doctorate	9%	14%	2%
Column average	7%	13%	4%

Note: Results are based on percentage effects in Panel C of Tables 2, 3, and 4, divided by the number of years of full-time study assumed for each the qualification (1 year for Certificate III/IV, 2 years for a Diploma or Advanced Diploma, 3 years for a Bachelor degree, 4 years for a Graduate Diploma or Graduate Certificate, and 5 years for a Masters or Doctorate). 'ns' denotes results that are not statistically significant at conventional levels. Column average includes 'ns' results.

To what extent might these estimates be driven by signalling effects, rather than by education increasing individuals' human capital? The signalling theory of education posits that a positive association between education and earnings is due to the way in which educational qualifications send a signal to potential employers that a job applicant will be a good worker. Perfectly disentangling the two hypotheses is impossible (Huntington-Klein 2020). As Gunderson and Oreopolous (2020) point out, if employers take time to learn about a worker's ability, signalling can have long-lasting effects that are difficult to separate from human capital effects.

However, some insights can be gleaned from 'sheepskin' effects (so-called because many universities printed degrees on sheepskin until the mid-twentieth century). If education's value is purely in human capital, then the returns to a year of education that involves completing a stage (such as finishing high school or graduating from university) should be the same as the returns to an intermediate year of education. Some evidence in favour of this theory can be seen in the fact that the per-year returns to completing year 11 are smaller than the per-year returns to completing year 12 (Table 5, Panel A). Suggestive evidence of a sheepskin effect can also be seen in the fact that the year 10 coefficients are larger than the year 11 coefficients (although most are statistically insignificant).

However, prior research appears to reject a pure signalling theory of returns to university. For example, Norton, Cherastidtham and Mackey (2018) find that Australian students who drop out of university tend to earn more than those who do not commence a degree, and that many university dropouts report that what they learned at university helped them in the labour market.

4 Have Returns to Education Changed Over Time or Across the Lifecycle?

A small literature analyses how returns to education have changed from decade to decade. For example, Wei (2016) finds that the economic returns to an Australian university degree rose from 1981 to 2011, while Corliss et al (2020) conclude that the returns to a degree fell from 2006 to 2016. Psacharopoulos and Patrinos (2018) estimate returns to education in 139 countries between 1950 and 2014 and identify an increase in the average returns to higher education during this period. I have not been able to locate an Australian study that has estimated changes in returns to education across high schooling, vocational education and university. In this sense, my analysis of changing returns to education provides a broader picture than the prior literature (albeit that it only studies the period since 2001).

So, how have returns to education changed since the start of the twenty-first century? To test this, I estimate equation 1 separately for each year from 2001 to

2022. As with the regressions shown in Tables 2 to 4, all regressions include separate indicator variables for each single year of age, interacted with a sex indicator. For simplicity, the dependent variable in each instance is log annual earnings (the substantive conclusions are not materially changed if log hourly wages are used instead).

Figure 1 plots the schooling coefficients from this regression, with the 95 percent confidence interval denoted by the shaded area. Over the first two decades of the twenty-first century, I find little evidence of an upwards or downwards trend in returns to completing year twelve. Although there are some fluctuations, they are well within the confidence interval. In the first and last year of the sample period, the schooling coefficient is around 0.4.

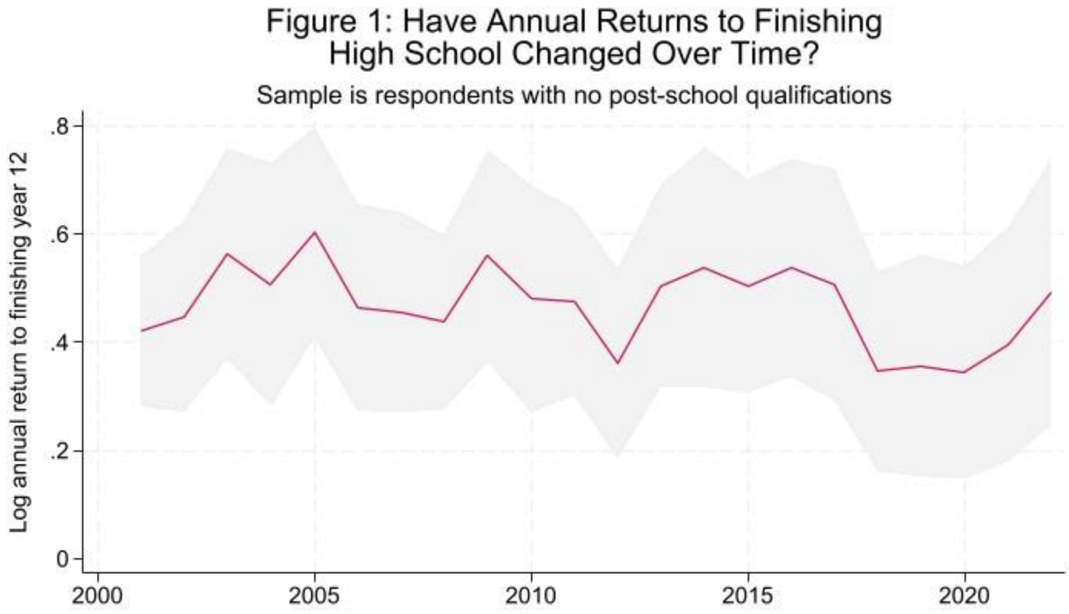


Figure 2 repeats the same exercise for a Certificate III or IV (where the comparator is someone with 11 or fewer years of schooling). Figure 3 repeats the exercise for a bachelor's degree (where the comparison is someone with 12 years of schooling and no post-school qualifications). Again, I find little evidence that the economic returns to vocational or university qualifications have changed over time in Australia. In Figure 2, the regression coefficient on a Certificate III or IV fluctuates around 0.2. In Figure 3, the coefficient on a Bachelor's degree fluctuates around 0.4.

These results are consistent with the findings of Borland and Coelli (2023), who note that growth in demand for workers with higher levels of education has been offset by growth in the supply of more educated workers. With the two effects approximately in balance, earnings differentials between education groups have not noticeably widened over the period 2001 to 2022.

Figure 2: Have Annual Returns to a Certificate III/IV Changed Over Time?

Sample is respondents with 11 or fewer years of schooling

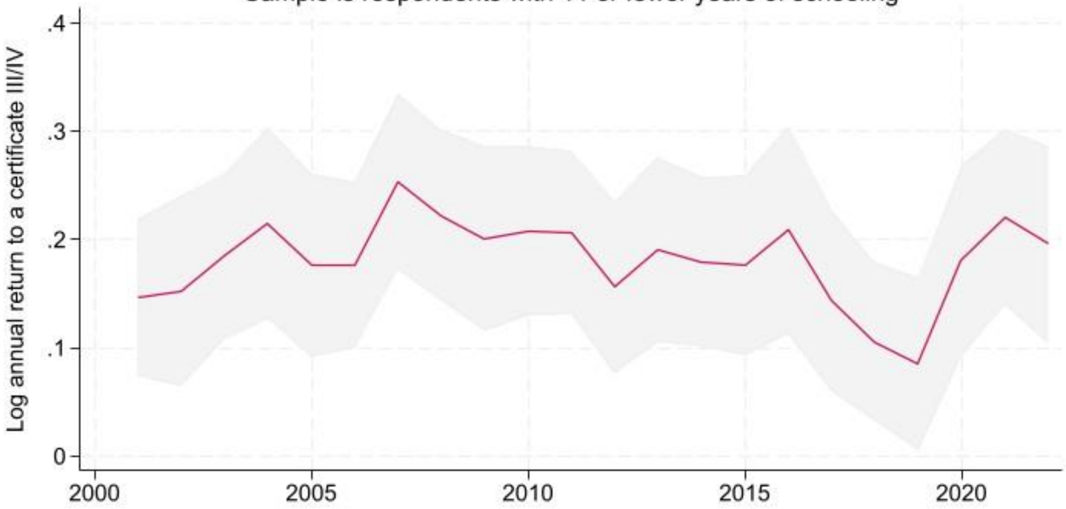
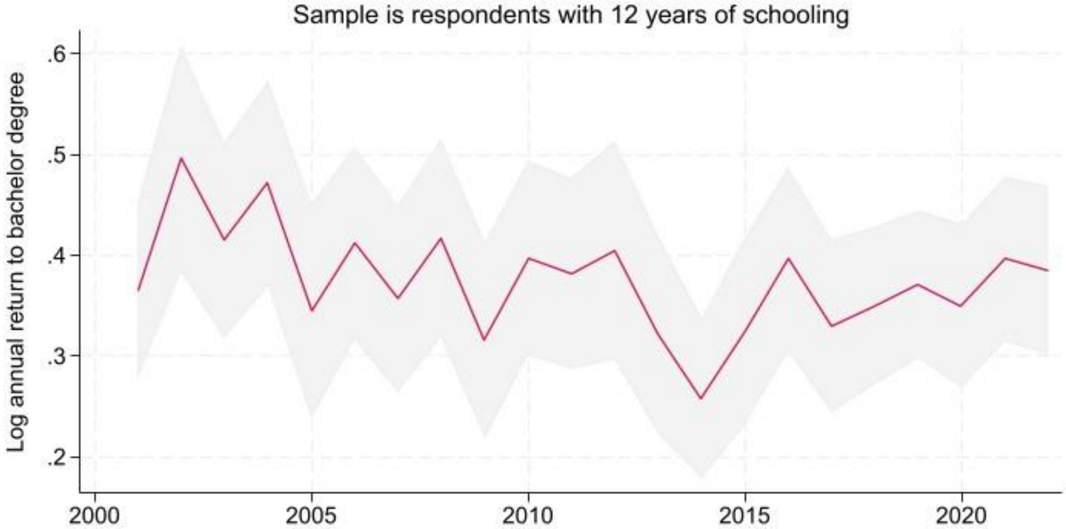


Figure 3: Have Annual Returns to a Bachelor Degree Changed Over Time?

Sample is respondents with 12 years of schooling



Next, I test for changes in education over the lifecycle. Using the full dataset (2001 to 2022) and controlling for sex and including year indicators, I estimate returns to education separately for each individual year of age from 25 to 64. As with Figures 1 to 3, the results in Figures 4 to 6 show the education coefficients as a line, and the shaded area around it as the 95 percent confidence interval. For ease of interpretation, I omit the portion of the shaded area that lies below the x-axis (ie. the portion suggesting negative returns to education).

Figure 4: Do Annual Returns to Finishing High School Change Over the Lifecycle?

Sample is respondents with no post-school qualifications

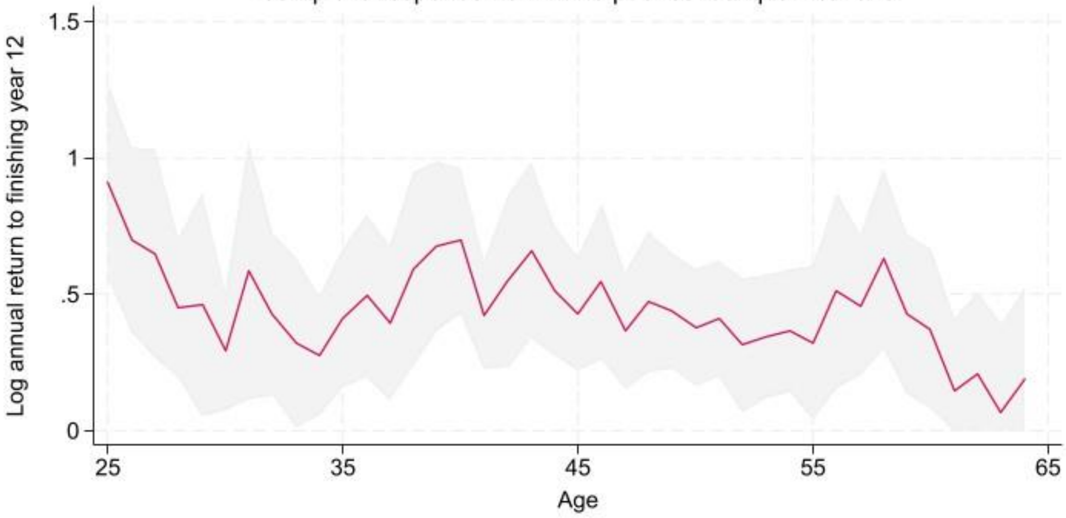
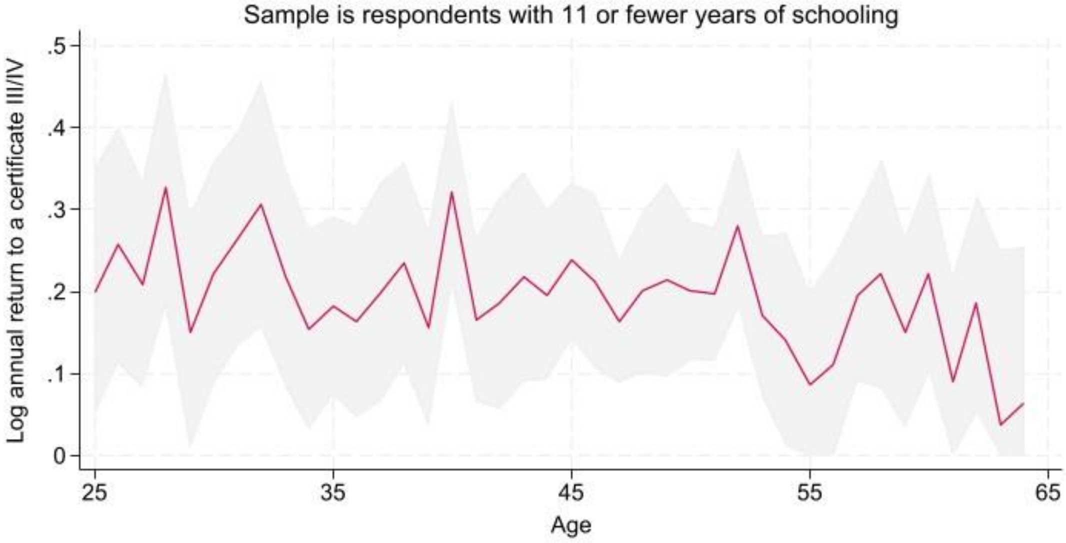
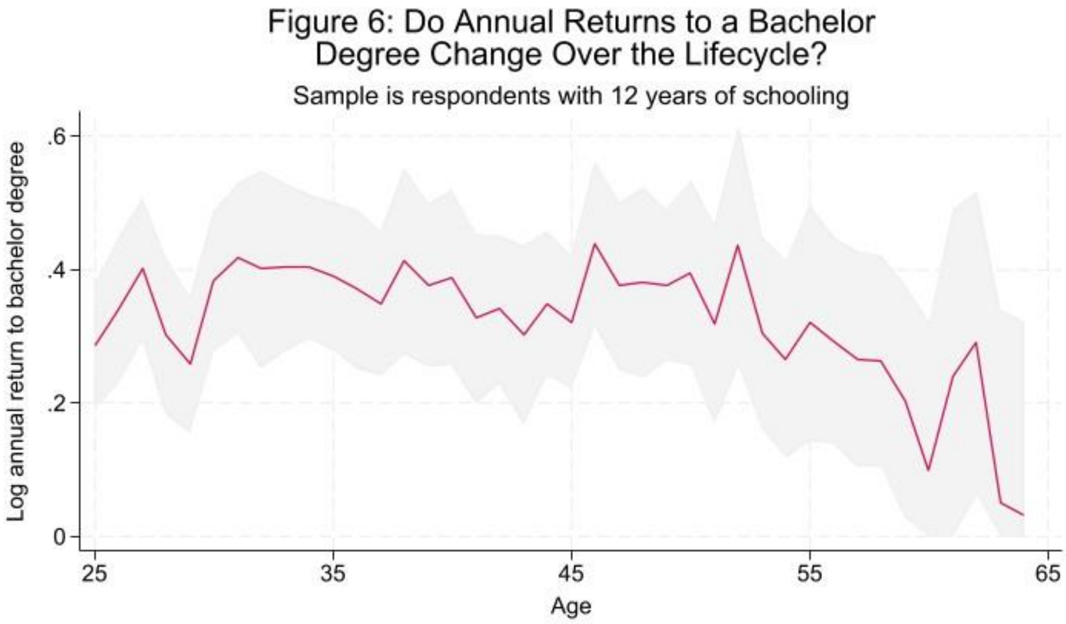


Figure 5: Do Annual Returns to a Certificate III/IV Change Over the Lifecycle?

Sample is respondents with 11 or fewer years of schooling





These figures do show some evidence of a systematic change in returns to schooling across the lifecycle. For completion of year 12 and vocational qualifications, the economic returns decline after about age 60. For a Bachelor's degree, the economic returns decline after about age 55. Note that these results are quite different from Deming (2023), who estimates that the United States college wage premium increases over the lifecycle, doubling from age 25 to age 55.

5 Conclusion

Using ability bias estimates in the published literature, and data from 2018-2022, I estimate returns to a wide variety of educational qualifications. These estimates suggest that the increase in hourly wages from raising educational attainment by one year averages 7 percent. Comparing across all qualifications, the productivity gain appears to be largest for Bachelor degrees.

When participation effects – on the intensive and extensive margin – are taken into account, the benefits of education and training are larger still, averaging a 13 percent increase in annual earnings per year of education. Focusing on annual earnings favours high schooling the most. For example, among people with no post-school qualifications, the annual earnings increase from completing year 12 is estimated to be a massive 27 percent. This supports the decision of various state and territory governments in recent decades to raise the minimum school leaving age.

Using the full HILDA dataset from 2001 to 2022, I find little evidence that returns to education in Australia changed during the first two decades of the millennium. However, I do find evidence of changes in returns to education over the lifecycle. In particular, returns to completing year 12 and completing a Certificate Level III or IV decline from around age 60, while returns to completing a Bachelor's degree decline from around age 55. Economic returns to these educational qualifications appear to be highest among younger workers.

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